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ABSTRACT

In 1985-86 the "Women in the Technical Curricula" project was developed at Queensborough Community College to encourage more women to choose a technical curriculum and to provide support services to help them successfully complete the curriculum. The project activities were designed to eliminate the stereotype of mathematics and related careers as masculine domains. Female tutors and female computer lab technicians, peer tutoring, scheduled review sessions, and access to computer-assisted instructional materials were provided to help women develop confidence in their mathematics ability. The retention rate for women in technical curricula increased from 53% to 61.2% after exposure to the new program. In addition, the dropout rate for women in remedial mathematics decreased at the end of the experimental year compared to the previous 2 years. An expanded project emphasizing career education and targeting local high school seniors was implemented in the 1988-89 school year. This project focused on increasing the number of women who elect to take technical curricula, increasing the retention rates of women in technical curricula, and disseminating information about careers for women in nontraditional technical fields. Support services similar to those offered the previous year were provided. In conjunction with Gruman Aircraft Systems, IBM, and AT&T Bell Laboratories, a Career Day was held with presentations from women within these industries. The 1988-89 results were also successful, with retention rates for women increasing from 70.5% in 1987-88 to 89.2% in 1988-89. Appendixes include a 14-item bibliography, a Career Day program, and a list of projects designed to encourage women to pursue careers in science and technology. (WJT)

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WOMEN IN SCIENCE AND TECHNOLOGY

by Dr. Mona Fabricant
and
Dr. Haya Adner

Queensborough Community College
Bayside, New York 11364

Project Title: Women in the Technical Curricula

Funding Source: Grant under the Carl D. Perkins Vocational Education Act, administered by the New York State Education Department.

Presentation: "Women in Science and Technology"
AMATYC's Fifteenth Annual Convention
October 28, 1989

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WOMEN IN SCIENCE AND TECHNOLOGY
PRESENTATION

Dr. Mona Fabricant and Dr. Haya Adner
QUEENSBOROUGH COMMUNITY COLLEGE
BAYSIDE, NEW YORK 11364

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Women represent approximately 52% of the population and 49% of total employment in professional and related occupations; yet only 15% of the scientific and engineering work force is composed of women (NSF Report, Jan. 1988, p.vii). For many years far fewer women than men have aspired to or obtained jobs in quantitative and technical fields. Until recently, this fact was attributed to innate differences between the sexes in mathematical ability or to the small number of "career women" in the labor force. Moreover, women were discouraged from pursuing technical careers. In the past decade these viewpoints have been challenged. First, more and more women are planning for and seeking careers rather than "jobs". Today the question is no longer "to work or not to work", but rather when to work and at what job. Second, studies suggest that the small representation of women in quantitative and technical fields may not be the result of innate differences in ability but may be caused by early decisions not to study technical subjects and mathematics, since until recently, preparation for a career outside the home did not seem important. Even now women choose not to follow the path to jobs in quantitative fields, and also delimit their career options and advancement opportunities in many technical fields which have a mathematical basis.

Queensborough Community College has several high technology programs. The Computer Engineering Technology and Electrical Engineering Technology programs are borh accredited by the Accreditation Board for Engineering and Technology. Students graduating with an A.A.S. degree can find jobs in industry or continue their studies and receive a Bachelor's degree in Electrical Engineering or Computer Science. The Mechanical Engineering Technology program is accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology. Students who elect the Design Drafting Curriculum receive working experience in Computer-Aided Drafting Design. These students may also choose to study Architecture and Construction. Queensborough Community College offers a unique program in Laser and Fiber Optic Technology. This is one of the fastest growing technical fields according to the Federal Bureau of Labor Statistics. Students completing one of the above curricula can find jobs with companies such as Bell Labs, Con Edison, Eastman Kodak, IBM, Grumman, Wang, and Xerox.

Below is a table showing the number of students at Queensborough who chose a technical curriculum in each year from 1983 to 1988 and the percent of those students who were women.

ENTERING FRESHMEN WHO CHOSE A TECHNICAL CURRICULUM

YEAR	TOTAL NUMBER OF STUDENTS	PERCENT FEMALE
1983	537	14.2
1984	470	9.1
1985	421	10.2
1986	353	11.0
1987	356	8.1
1988	307	8.8

In 1985-1986 a pilot project entitled "Women in the Technical Curricula" (Dr. Mona Fabricant, Principal Investigator) was implemented. This project was funded by a grant under the Carl D. Perkins Vocational Education Act, administered by the New York State Education Department. The goal of this project was to encourage more women to choose a technical curriculum and then provide support services to help them successfully complete the curriculum. The activities in the project were designed to reduce or eliminate the sex stereotyping of mathematics and related careers as masculine domains and provide more encouragement and support for women's achievement in the classroom.

Since approximately 75% of students entering Queensborough Community College need remedial mathematics, support services to help women complete the first remedial mathematics course with enough confidence in their mathematical ability to continue to study mathematics were developed. These included peer tutoring, scheduled review sessions, and access to appropriate computer-assisted instructional materials. Providing female role models in mathematics and technology was an important aspect of this project. Female tutors and computer lab technicians were hired (previously all tutors and technicians were male). The tutors and technicians were Queensborough Community College students who were successfully completing a technical curriculum. Also included in the pilot project were a few sessions of career counseling for incoming feshmen provided in conjunction with the Counseling Department. Women in our technical programs were invited to speak to incoming freshmen about their experiences in pursuing technical careers.

One result of this pilot project was that the retention rate for women in the technical curricula exposed to this sex equity program increased significantly from 53% to 61.2%. Anecdotal data revealed that women felt less intimidated requesting help from the female tutors and technicians and therefore asked for

and received more help in their mathematics courses. This was demonstrated statistically by a significant decrease in the dropout rate for women in remedial mathematics at the end of the experimental year compared to the dropout rate in the two previous years.

An expanded project emphasizing career education and reaching out to seniors in local high schools was implemented in the 1988-1989 school year funded by a grant under the auspices of the Carl D. Perkins Vocational Education Act. The objectives of this project were as follows:

1. To increase the number of women who elect to take technical curricula.
2. To increase the retention rate of women in the technical curricula.
3. To disseminate information about careers for women in nontraditional technical fields.

Support services similar to those offered in the pilot project were implemented, namely peer tutoring and expanded access to appropriate computer-assisted instruction in the mathematics computer lab. Career counseling in conjunction with the Counseling Department was expanded to try to reach as many incoming freshmen as possible. The women computer laboratory technicians gave talks about their experiences in pursuing technical careers as part of these career counseling sessions.

A major innovation in the expanded project was the planning of a Career Day in conjunction with Grumman Aircraft Systems, IBM, and AT&T Bell Laboratories. (Dr. Haya Adner was the Liaison with Industry.) Career Day was an interdepartmental effort with the chairs of the various technology departments participating. (See Attachment A for the program for Career Day.) Eight local high schools agreed to participate by sending senior female students with some aptitude and interest in mathematics to participate in the program. Over 100 high school

students and 40 Queensborough Community College students spent the day listening to female speakers from industry, taking part in demonstrations in various technical laboratories and mingling socially with representatives from the participating industries.

The results of this project were very encouraging. The retention rate for women in technical curricula exposed to this sex equity program increased significantly from 70.5% in 1987-1988 to 89.2% in the 1988-1989 school year (experimental year.) The anecdotal data showed that women felt less intimidated requesting help from the female tutors and technicians and therefore asked for and received more help in their mathematics courses.

The feedback from the high schools was positive. A number of schools requested that we think about making Career Day an annual event.

There are a number of projects throughout the United States whose goals are to encourage women to pursue careers in science and technology (see Attachment B.) A project at Rutgers University to encourage women to pursue careers in science and technology includes a dormitory at Douglass College specifically designated for undergraduate women in science and technology. The residents of this facility will be 100 undergraduate women majoring in mathematics and science along with 10 women graduate students in mathematics and science who will serve as mentors for the undergraduates. Included in this program are career workshops, interships and seminars with visiting professors.

The problem of a dearth of women who choose to seek careers in science and technology is not unique to our country. Ann Moskol (Associate Professor of Mathematics and Computer Science at Rhode Island College) received a grant from the Swedish Institute for a visit to Sweden in 1988 to study Swedish projects to encourage women to enter technical careers.

Swedish students enter a career track in upper secondary school. In the ninth grade student apply to study a specific area of specialization for upper secondary school. Girls typically choose to major in humanistic and social services while boys more often choose technical areas.

The solutions they are trying are as follows:

1. Start in preschool to train both teachers and girls to use technology.
2. Teach students about career opportunities through discussions, visits, and on-site training.
3. Have support programs for girls to prevent dropouts.
4. Have on-campus visits to colleges to familiarize students with opportunities to study science, mathematics, and technology. (AWM Newsletter, May-June 1989, pp 6-7)

To meet the present and future technological and scientific needs of our country, it is essential to encourage women to pursue careers in technology and science. The project at Queensborough Community College is one model that has potential for attaining this goal.

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PROGRAM

9:30-10 a.m.
GOOD MORNING
Coffee, Juice, Bagels, Cakes

10-10:15 a.m.
WELCOME
Dr. Marcia Keizs
Dean of Students

10:15-11 a.m.
SESSION I

Topic:
"The Role of Women in Developing New Technologies for the 90's"

Speaker:
Lucie A. Schmidtmann
Staff Member
Undersea System Development Laboratory
AT&T Bell Laboratories

11-11:45 a.m.
SESSION II

Topic:
"Skills and Abilities Needed in the Fields of Science and Engineering"

Speaker:
Patricia Hasson
Engineer, Technology Thrust on Expert Systems
Grumman Aircraft Systems

11:45 a.m.-12:45 p.m.
TOURS OF QCC'S TECHNICAL LABORATORIES

- Electrical and Computer Engineering Technology
  Professor Joseph B. Aidala, Chairperson
- Mechanical Engineering and Design Drafting
  Professor Sheldon I. Kohen, Chairperson
- Laser and Fiber Optics Technology
  Professor Don P. Engelberg, Acting Chairperson
- Music Electronic Technology
  Professor Myron Rosenblum, Chairperson

12:45-1:15 p.m.
LUNCHEON

1:15-2 p.m.
SESSION III

Topic:
"Why Should Women Choose Careers in Science and Technology"

Speaker:
Barbara J. Ellis
Branch Manager
IBM

Funded by a grant under the Carl D. Perkins Vocational Education Act administered by the New York State Education Department
Dr. Mona Fabricant, Grant Director
Dr. Haya Adner, Liaison with Industry and Career Day Coordinator

For information: 718-631-6361

Attachment A

ATTACHMENT B (1)

PROGRAMS TO ENCOURAGE WOMEN TO STUDY MATHEMATICS

1. EQUALS

PROVIDES BOOKS AND MATERIALS ON METHODS FOR HELPING GIRLS SUCCEED IN MATHEMATICS.

ADDRESS: EQUALS
LAWRENCE HALL OF SCIENCE
UNIVERSITY OF CALIFORNIA
BERKELEY, CALIFORNIA 94720

BOOKS: MATH FOR GIRLS AND OTHER PROBLEM SOLVERS
Diane Downie, Twila Slesnick, Jean Kerr Stenmark

USE EQUALS TO PROMOTE PARTICIPATION OF WOMEN IN MATHEMATICS
Alice Kaseberg, Nancy Kreinberg, Diane Downie

2. FUTURES UNLIMITED PROJECT

PROVIDES INFORMATION ON RUNNING WORKSHOPS WHERE FEMALE JUNIOR HIGH SCHOOL STUDENTS CAN MEET WOMEN WORKING IN MATHEMATICS AND MATHEMATICS-BASED FIELDS.

ADDRESS: FUTURES UNLIMITED
ARLENE S. CHASEK, PROJECT DIRECTOR
CONSORTIUM FOR EDUCATIONAL EQUITY
RUTGERS, THE STATE UNIVERSITY OF NEW JERSEY
NEW BRUNSWICK, NEW JERSEY 08903

3. KEEP YOUR OPTIONS OPEN

PROVIDES INFORMATION ON RUNNING WORKSHOPS TO EXPAND CAREER OPTIONS FOR GIRLS IN NON-TRADITIONAL TECHNICAL FIELDS.

ADDRESS: KEEP YOUR OPTIONS OPEN
LINDA NIGHTINGALE GREENWOOD
RHODE ISLAND DEPARTMENT OF ELEMENTARY AND SECONDARY EDUCATION
22 HAYES STREET
PROVIDENCE, RHODE ISLAND 02908

4. WOMEN AND MATHEMATICS

PROVIDES WOMEN MATHEMATICIANS TO SPEAK TO CLASSES IN JUNIOR AND SENIOR HIGH SCHOOLS.

ADDRESS: WOMEN AND MATHEMATICS
MATHEMATICS ASSOCIATION OF AMERICA
1529 EIGHTEENTH STREET. N.W.
WASHINGTON, D.C. 20036

ATTACHMENT B (2)

5. ASSOCIATION FOR WOMEN IN MATHEMATICS

PUBLISHES A NEWSLETTER WHICH GIVES LATEST INFORMATION ON PROJECTS FOR HELPING WOMEN IN MATHEMATICS AS WELL AS A TREMENDOUS AMOUNT OF INFORMATION OF WOMEN MATHEMATICIANS AND SCIENTISTS BOTH FROM AN HISTORICAL POINT OF VIEW AND FROM THE PRESENT.

ADDRESS: ASSOCIATION FOR WOMEN IN MATHEMATICS
BOX 178, WELLESLEY COLLEGE
WELLESLEY, MA 02181

6. NATIONAL WOMEN'S HISTORY PROJECT

PROVIDES INFORMATION ON WOMEN IN MATHEMATICS (BIOGRAPHIES) AND ACTIVITIES FOR HELPING GIRLS SUCCEED IN MATHEMATICS.

ADDRESS: NATIONAL WOMEN'S HISTORY PROJECT
P.O. BOX 3716
SANTA ROSA, CA 95402

BOOK: WOMEN, NUMBERS AND DREAMS
Teri Hoch Perl, Joan M. Manning

7. WOMEN IN THE TECHNICAL CURRICULA

PROVIDES INFORMATION ON ORGANIZING A CAREER DAY FOR HIGH SCHOOL STUDENTS TO ENCOURAGE THEM TO PURSUE NON-TRADITIONAL TECHNICAL CAREERS.

ADDRESS: DR. MONA FABRICANT, PROJECT DIRECTOR
DEPT. OF MATHEMATICS AND COMPUTER SCIENCE
QUEENSBOROUGH COMMUNITY COLLEGE
56th AVE. AND SPRINGFIELD BLVD.
BAYSIDE, NEW YORK 11364

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